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National Iranian Gas Co.

مدیریت پژوهش و فناوری

Research and Technology Management

امور تدوین استانداردها

Standardization Division

IGS

Iranian Gas Standards

Specification for :

مشخصات فنی :

Inhibitor for Hydrochloric Acid Cleaning

مواد بازدارنده برای اسیدشویی

APPROVED

FOREWORD

This standard is intended to be mainly used by **NIGC** and contractors and has been prepared on interpretation of recognized standards , technical documents , knowledge ,backgrounds and experiences in gas industries at national and international levels.

Iranian Gas Standards (**IGS**) are prepared , reviewed and ammended by technical standard committees within NIGC Standardization Div. and submitted to the **NIGC's "STANDARDS COUNCIL"** for approval .

IGS Standards are subject to revision , amendment or withdrawal , if required , thus the latest edition of **IGS** shall be checked/inquired by **NIGC** users .

This standard must not be modified or altered by the end users within **NIGC** and her contractors. Any deviation from normative references and/or well known manufacturers specifications must be reported to Standardization div.

Any comments from concerned parties on **NIGC** distributed **IGS** are welcome to technical standards committees and will receive serious attention and consideration should a revision to standards is recommended .

GENERAL DEFINITIONS :

Throughout this standard the following definitions , where applicable , should be followed :

1- "**STANDARDIZATION DIV.**" has been organized to deal with all aspects of industrial standards in NIGC . Therefore , all queries for clarification or amendments are requested to be directed to the mentioned div.

2- "**COMPANY** " : refers to national iranian gas company .

3- "**SUPLIER**" : refers to a firm who will supply the service , equipment or material to igs specification whether as the prime producer or manufacturer or a trading firm .

4- "**SHALL**" : is used where a provision is mandatory.

5- "**SHOULD**" : is used where a provision is advised only.

6- "**MAY**" : is used where a provision is completely discretionary.

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پیشگفتار

- ۱- این استاندارد/دستورالعمل بمنظور استفاده اختصاصی در شرکت ملی گاز ایران و شرکتهای فرعی وابسته تهیه شده است.
- ۲- شرکت ملی گاز ایران در مورد نیازهای عمومی از استانداردهای وزارت نفت (IPS) و در مورد نیازهای اختصاصی از استانداردهای اختصاصی خود (IGS) استفاده می نماید.
- ۳- استانداردهای شرکت ملی گاز ایران (IGS) توسط کمیته های تخصصی استاندارد متشکل از کارشناسان بخش های مختلف و یا مشاور تهیه می شود و توسط شورای استاندارد (منتخب هیئت مدیره شرکت ملی گاز ایران) به تصویب میرسند.
- ۴- در تنظیم متن استانداردهای (IGS) از کلیه منابع شناخته شده استاندارد، اطلاعات فنی - تخصصی مربوط به صنایع گاز دنیا، مشخصات فنی تولیدات سازندگان معتبر جهانی و نیز از نتیجه تحقیقات و تجربیات کارشناسان و متخصصان داخلی بر حسب مورد استفاده می شود. همچنین بمنظور استفاده هر چه بیشتر از تولیدات داخلی قابلیت های سازندگان داخلی نیز مورد توجه قرار میگیرد.
- ۵- استانداردها از طریق پایگاه اینترنتی شرکت* و یالوح فشرده (CD) در اختیار واحدها و کاربران قرار می گیرد .
- ۶- استانداردها بطور متوسط هر ۵ سال یکبار و یادر صورت ضرورت زودتر، مورد بازنگری و بروزرسانی قرار میگیرند. بنابراین کاربران باید همیشه آخرین نگارش را مورد استفاده قرار دهند.
- ۷- هرگونه نظر و یا پیشنهاد اصلاح در مورد استانداردها مورد استقبال و بررسی قرار خواهد گرفت و در صورت تأیید، استاندارد مربوطه نیز مورد تجدیدنظر قرار خواهد گرفت .

تعاریف عمومی

در متن استانداردهای (IGS) از تعاریف و اصطلاحات زیر استفاده میشود.

- ۱- "شرکت" (COMPANY): منظور از شرکت "شرکت ملی گاز ایران" و یا شرکتهای فرعی وابسته میباشد.
- ۲- "فروشنده" (SUPPLIER/VENDOR): به فرد یا موسسه ای اطلاق میگردد که تعهدی رانسبت به شرکت تقبل نموده است.
- ۳- "خریدار" (PURCHASER): منظور از خریدار "شرکت ملی گاز ایران" و یا شرکتهای فرعی وابسته میباشد.
- ۴- "SHALL": در مواردی بکاربرده میشود که انجام خواسته مورد نظر اجباری است
- ۵- "SHOULD": در مواردی بکاربرده میشود که انجام خواسته مورد نظر ترجیحی و درعین حال اختیاری است
- ۶- "MAY": در مواردی بکاربرده میشود که انجام کار به شکل مورد بحث نیز قابل قبول میباشد

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1. SCOPE

This standard gives the procedure for purchasing inhibitor(s) which will be used for inhibiting hydrochloric acid to minimize the deleterious effects of acid on metals when acid used for removal of deposits, scale and corrosion products developed on the surface .

2. REFERENCE

Throughout this standard the following standard is referred to. The edition of this standard that is in effect at the time of issues of this standard (2000) shall, to the extent specified herein, from part of this standard. The applicability of changes in standard that occur after the date of this standard shall be mutually agreed upon by the purchaser and supplier .

US MILITARY STANDARDS

MIL-STD-105 “ Sampling Procedures and Tables for Inspection by Attributes”

3. SYSTEM DESIGN

The supplier shall supply inhibitor(s) to be able to minimize the deleterious effects of hydrochloric acid on metals, while not interfere with the removal of deposits, scale and corrosion products developed on the surface .

The proposed inhibitor(s) shall also meet the following requirements :

3.1 Definitions

Approved products: The approved products are those products whose approval test samples (see 4.1) have been laboratory tested and have passed the approval tests specified herein (see 4) and have been listed on or approved for being listed as approved samples .

Approved suppliers: The suppliers of approved products will be known as approved suppliers .

Qualified products: the qualified products mean the approved products proposed with respect to this standard which meet all requirements of this standard .

Qualified supplier(s): The supplier of qualified product(s) will be known as the qualified supplier(s) .

Final supplier: The successful bidder is known as the final supplier .

3.2 Formulation Changes

The presented material(s) for supply shall be accepted only for the formulation for which approval tests are made. Any change(s) in formulation, shall cause for

designating the material as a new material which shall not be considered accepted. The supplier may submit the modified material for acceptance under this standard, using a new supplier's designation .

3.3 Applicability

Inhibitor(s) shall be easily applicable when used for loading in to the system without any vigorous or impractical effort .

3.4 Criteria

3.4.1 Weight loss

The weight loss, that is a direct measure of corrosion rate of a test system with added inhibitor and is evaluated with protection efficiency of corrosion inhibitor, shall not exceed 9.77 grams per square meter per hour (0.002 pound per square foot per hour) when tested as specified in 10.1 .

3.4.2 Strength

Use dosage of inhibitor shall not exceed 0.2 percent by weight in order to limit metal loss as specified in 3.4.1 .

3.4.3 Compatibility

The inhibitor(s) at dosage required in 3.4.2 must be compatible with the acid solution as formulated in 10.1.1 .

The inhibited acid solution shall not cause filming , staining , or adherent deposits on metal surfaces. These effects will be ascertained from visual observation of specimens following the test specified 10.1.4 .

3.4.4 Miscibility

The inhibitor (s) shall be completely miscible in acid solution and must provide metal protection as specified in 3.4.1 .

3.4.5 Arsenic

The inhibitor shall not contain more than 0.01 percent of arsenic when tested as specified in 10.2 .

3.4.6 Foam

No stable foam shall form in the inhibited acid solution when tested as specified in 10.3.

3.5 Economical Aspects

The proposed inhibitor(s) shall meet the requirements of clause 3.1 at the lowest cost. The cost evaluation will be made by the purchaser (technical department of enduser in this case), with reference to the performance of the product(s) (see 3.1), including cost of product(s) and other costs such as forwarding shipment, storage, operation and so on.

4. APPROVAL TESTS

Approval tests are the laboratory tests performed on the samples submitted for approval. The approval tests of the inhibitor(s) will consist of the tests of this standard (see 10) .

4.1 Approval Test Samples

4.1.1 Approval test sample(s) shall consist of sufficient amount of material(s) proposed as an inhibitor(s) furnished under this standard.

Sample(s) shall be forwarded to the purchaser. Sample(s) shall be plainly indentified by securely attached durable tags or labels marked with following information :

Sample for Qualification Tests (or approval tests)

Brand Name

Name of Production Plant (plant where inhibitor is mass produced)

Material Designation (product ref / code)

Date of Production

4.1.2 The supplier shall also provide the operational information with each sample as follows :

Description and Function (s)

Analytical Control

Instruction for Use

Handling

Storaging

Shelflife

Others

4.1.3 The supplier shall specify physical properties for the material(s) covering the followings :

Form

PH

Color

Odor

Pour Point

Flash Point

Viscosity at 20⁰ C

Specific Gravity

Density at 20⁰ C

Solubility in Water at 20⁰ C

Others

5. PRODUCTION TESTS

Production tests are the ones normally performed by the producer on samples taken from production run during the production of inhibitor(s) according to its own quality standard. The supplier shall provide the production tests reports to the mentioned standard .

6. QUALITY ASSURANCE

The supplier shall provide a quality assurance certificate to ensure that the inhibitor(s) proposed complies with this standard .

7. STORAGE LIFE AND PACKAGING

7.1 Storage Life

The inhibitor(s) shall meet all requirements of this standard at least 24 months from date of delivery .

7.2 Packaging

The material(s) shall be suitably packaged in 20-25 kg new drum protected against all

damages or defects which may occur during handling and seaworthy shipment .

7.3 Compatibility of the Container with Inhibitor(s)

The container material shall be compatible with inhibitor(s) to the extent that it shall not cause delamination, swelling , embrittlement , dissolution , or other deterioration such as to causing the degradation of the container material .

8. INSPECTION AND QUALITY ASSURANCE (QA)

- 8.1 The supplier shall be responsible for carrying out all the tests and QA's required by this standard (see 10), using his own or other reliable facilities, and he shall maintain complete records of all such tests and qualifications. Such records shall be available for review by the purchaser. The supplier shall furnish to the purchaser a certificate of quality stating that each lot has been sampled , tested , and qualified in accordance with this standard and has been found to meet the requirements specified.
- 8.2 An inspection lot shall consist of a batch (or batches) of production processed from the same material components, and offered for inspection at one time .
- 8.3 The supplier shall afford the purchaser's inspector all reasonable facilities required for inspection of each batch of production in accordance with this standard.. Such inspection in no way relieves the supplier of his responsibilities under the term of this standard .
- 8.4 The purchaser reserves the right to perform any inspections set forth in this standard where such inspections are deemed necessary to assure that supplies and services conform to the prescribed requirements .
- 8.5 The purchaser's inspector reserve the right to have access to the materials subject to inspection for the purpose of witnessing selection of the samples, preparation of the test samples and performance of the test(s). For such tests , the inspector reserves the right to indicate the sample(s) from which the quantities will be taken in accordance with the provisions of this standard .

8.6 Sampling for Visual Inspection

The random sample(s) of filled containers shall be selected from each inspection lot by purchaser's inspector in accordance with standard MIL-STD-105 at Inspection Level I and (AQL) 2.5 percent defective to verify conformance to all requirements of this standard regarding fill, closure and marking .

9. MARKING

9.1 Marking of Containers

Each container shall be legibly marked at least with following information:

Supplier's Name and Address

Purchaser's Name and Address

Standard Specification: (IGS-MS-CH-036-2000)

MESC NO.

Handling Guidelines

Storing Symbols

Date of Manufacture

Batch No .

9.2 Instruction

Supplier shall provide complete sets of instructions for use .

9.3 Precautionary Marking

All individual containers shall be marked with precautionary symbols or phrases .

10. TEST METHODS

10.1 Weight Loss

The weight loss shall be determine as follows :

10.1.1 Formulation of solution

The inhibited acid solution shall be formulated as follows :

Hydrochloric acid (specific gravity 1.19, assay 37 percent)	120 milliliters
Ferric chloride (FeCl ₃ , 6H ₂ O)	15 grams
Cupric chloride (CuCl ₂ , 2H ₂ O)	0.31 grams
1, 3 Diethylthiourea (DETU)	5.2 grams
Inhibitor, concentration	final concentration not to exceed 0.2 percent by weight of final solution
Distilled water	sufficient amounts to obtain 500 ml of inhibited acid solution

10.1.2 Preparation of solution

Heat solution to $77 \pm 1^{\circ}$ C, stir and pour 150 ml into each of two tall form beakers (approximately 54 mm diameter, 98 mm depth containing a 3 mm glass rod bent into a V shape to support test specimens during evaluations).

10.1.3 Coupon

Corrosion coupons shall be mild steel and shall have preferred sizing 73.0 x 22.2 x 3.2 mm (2-7/8" x 7/8" x 1/8") and shall be taken as having a density of 7.86 g/cm³.

Before testing, the coupons shall be degreased in acetone and wiped dry. Corrosion products shall be removed by placing the coupon in concentrated hydrochloric acid heated to approximately 52° C until removal is accomplished (usually about 5 minutes). Coupons shall then be rinsed with water, dipped in acetone, and wiped dry. Total surface area shall be measured to the nearest 0.4 mm. Wire brushing is then applied, followed by a momentary exposure to the acid and a water rinse. The coupons are then dipped in acetone, air dried and placed in a desiccator prior to weighing.

The weight of each coupon shall be determined to the nearest milligram. Stress relieving shall not be applied to the coupons.

10.1.4 Procedure

Coupons shall be placed in beakers containing the descalant solution described and as specified in 10.1.1. Acid shall be heated to 77° C and placed in a thermostatically controlled water bath maintained at $77 \pm 1^{\circ}$ C. Coupons shall remain in contact with acid for 6 hours, then removed, rinsed with hot (60° C to 65° C) water, dipped in acetone, air dried and weighed. Weight loss in grams per 6 hours shall be converted to

grams per square meter per hour. Determinations shall be run in duplicate and averaged. Result shall agree within 10 percent of the mean or the test shall be repeated.

10.2 Arsenic Content

This test shall be conducted as follows :

Place 10 grams of the sample in a 200 ml flask. Add 5 grams cuprous chloride and 75 ml HCL (sp. gr. 1.09), mix well, insert a thermometer and arrange the flask and condenser for downward distillation. Distill approximately 35 ml of the solution into 150 ml of cold water contained in a 400 ml beaker cooled in an ice or cold - water bath. (The condenser tip should dip below the surface of the water in the beaker. The distillation should be watched carefully to avoid suck - back.) The temperature of the vapors during distillation, shall remain below 106⁰ C, otherwise halt the distillation, cool the flask, and add 34 ml of concentrated HCL before continuing the distillation. Neutralize the distillate carefully with 25 percent NaOH solution, then add 1:1 HCL until just acid. Add 15 ml to 20 ml of cold - saturated NaHCO₃ solution. Add 1 gram of KI crystals and 5 ml of 1 percent starch solution. Stir until the KI is dissolved and titrate with 0.01N iodine solution.

$$\text{Percent arsenic} = \frac{3.75 AN}{W}$$

Where:

- A= ml of iodine solution used
- N= normality of iodine solution
- W= weight of sample

10.3 Foaming

This test shall be conducted as follows :

Place solution specified in 10.1.1 in beaker describe in 10.1.2. Heat solution to 77+1⁰C and shake vigorously. No stable foam shall be produced.